

FOAMED PRODUCTS OF SILICA AND MANUFACTURING THE SAME FROM SILICA GEL

This invention relates to granular foamed products of silica and to a method for producing the same from silica gel.

Silica gel has excellent fireproof and heat resisting properties, chemical stability, large specific surface area and high hygroscopicity. Due to these characteristics, silica gel finds applications as drying agent, catalyst carrier and the like. On the other hand, the inherent property of excess hygroscopicity results in a drawback that in the presence of water it absorbs water rapidly and is spontaneously broken to pieces. This drawback poses limitation on the application, hence it is put to only a narrow range of uses.

An object of the present invention is to produce from silica gel foamed products which have no hygroscopicity but possesses fireproof, heat resisting, chemical stability and yet which are much more lightweight and attractive in appearance than silica gel, the products therefore being applicable to new uses.

Another object of this invention is to provide foamed products with foregoing characteristics which have a high degree of whiteness or which are colored in a desired color so as to be applicable for a wide variety of uses as building materials, aggregates for paints, and the like and to provide a method for producing the same from silica gel.

In order to fulfill these objects the present inventors have carried out extensive studies on a method for foaming silica gel by heating. During the researches conducted, difficulties were encountered in that cracks or breakage developed or large pores were locally produced in the course of heating. Indeed, it was found difficult to obtain a foamed product of silica which is crack-free and of uniform porous construction. While carrying out subsequent researches, it has been found that insofar as silica gel is heated under particular conditions, foamed products of silica can be obtained which are crack-free and have uniform and minute open or semi-closed pores in the interior thereof.

In accordance with the present invention, a foamed product of silica gel is produced by prefiring silica gel at 500 to 900°C so as to obtain a prefired product which can be ignited with a loss of not more than 5 percent by weight, the silica gel having a specific surface area of at least 500 m²/g and being of a size not passing through an 80-mesh sieve and substantially free of adsorption water, and thereafter firing the prefired product at 1000 to 1450°C to effect foaming.

In accordance with this invention, the ignition loss was measured by heating the sample at 1000°C for 2 hours and the specific surface area was measured by the BET method under the condition of 1-hour bake-out treatment at 300°C. As the adsorption gas used for the latter measurement, a nitrogen gas was used for starting silica gel and ethylene was used for the foamed product obtained.

The foamed product of silica obtained by this invention is a granule covered with a vitrified surface and having in its interior a great number of open or semi-closed pores which are defined by vitrified partitions. The pores are approximately 1 to 100 μ in diameter and distributed at a ratio of 1 × 10⁶ to 1 × 10¹² pores/cm³. Due to the presence of these numerous

pores, the foamed product of this invention has a bulk density as small as not more than 0.6 g/cm³. Since the granules are covered with vitrified surface, the product has a very small specific surface area of not more than 0.7 m²/g which corresponds to less than 1/700 the specific surface area of the starting silica gel, with the result that the hygroscopicity of the product is markedly lower than that of the starting gel. In fact the foamed product of this invention exhibits no hygroscopic action even when left under atmospheric conditions over a long period and shows only slight hygroscopicity of about 0.5 percent when left for 24 hours under a saturated steam pressure at 30°C. Further when immersed in water, rapid sorption of water which results in breakage does not take place although absorption of water may proceed slowly over a long period. Even in such instance, the product is not liable to variation in shape or deterioration of quality but remains very stable. Further the product has higher stability than silica gel in its resistance to chemicals, such as in acid and alkali resisting properties. Moreover the product has excellent luster on its vitrified surface and a foamed product obtained without using coloring material has a high degree of whiteness and looks almost pure-white and lustrous. A colored product also exhibits a desired color with luster. Being excellent in fireproof and heat resisting properties and having open or semi-closed cells in its interior, the product is lightweight and has outstanding abilities to insulate heat, keep warmth and absorb sound.

For these reasons, the foamed products of this invention can be used for various purposes wherein characteristics described above are essential. They are particularly useful as building materials and aggregates for paints. Although various materials have heretofore been proposed for use as building materials and aggregates of paints, they have drawbacks in that those of a lightweight have no luster on the surface while those with attractive appearance are not sufficiently lightweight. However the present foamed products are not only lightweight but also have a beautiful appearance. Accordingly, a building material incorporating the present product is lightweight and look beautiful, and a wall surface coated with a paint including this product provides an attractive appearance without adding to the weight. The present products further find versatile applications as heat insulating, refractory, warmth keeping, sound absorbing materials as well as for ornamental purposes.

It is desired that the foamed products of this invention generally have a specific surface area of 0.2 to 0.6 m²/g and a bulk density of 0.1 to 0.5 g/cm³ although these values may vary depending upon the use. The size of the pores in the interior of the foamed products, which may vary depending on foaming conditions, is preferably 1 to 100 μ in diameter and it is desired that the pores be present uniformly.

The present foamed products of this invention may assume versatile shapes depending upon the starting silica gel and foaming conditions. For instance, some are nearly precisely spherical, some are elliptical and others are in more complex shape. The size of the granular products also varies over a wide range and is generally from 0.2 mm to 25 mm in diameter. Depending upon the proposes, a product of a desired size and